AMENDMENTS TO THE DRAWINGS:

The attached sheet of drawings includes changes to FIG. 7, and replaces the original sheet including FIG. 7.

* * * *

REMARKS:

Claims 1-36 are currently being examined, none of which have been amended. No new claims have been added. It is respectfully believed that no new matter has been introduced.

Claims 19-36 stand allowed.

The Examiner has indicated that claims 3-5, 7, and 9-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicants appreciate this indication of allowable subject matter in claims 3-5, 7 and 9-18, and respectfully request that the Examiner hold this objection in abeyance while considering the remarks herein regarding base claim 1.

Fig. 7 has been amended to correct one reference symbol, by changing "18b" (one occurrence) to --18a--.

Claims 1, 2, 6, and 8 stand rejected under 35 USC 103(a) as obvious over USP 6,122,414 (**Shimizu**) in view of USP 5,675,673 (**Skeie**), USP 5,815,610 (**Tokano**), and USP 6,334,008 (**Nakabayashi**).

Applicants respectfully traverse this rejection.

Shimizu discloses a semiconductor Mach-Zehnder modulator comprising a pair of phase modulator arm waveguides and a single driver for a push-pull modulation.

Skeie describes an optical modulator having an electrode structure which is divided into a plurality of relatively small segments. The segments are connected via bond wires and transmission lines on an adjoining microwave circuit board.

Tokano discloses a system comprising a substrate 4, an incident optical waveguide 5 formed on the substrate for receiving a light beam incident thereto, and two phase-shift optical waveguides 6 formed on the substrate 4 to be branched from the incident optical waveguide.

Nakabayashi discloses an optical circuit which includes a plurality of optical wave guides each having an electro-optic crystal such as $LiNbO_3$ or $LiTaO_3$ and a domain orientation different from the other waveguide.

In claim 1, the two lower clad layers of the first phase modulation electrode and the second phase modulation electrode are electrically connected to each other via the bias layer which has the same conductivity (first conductivity type semiconductor) as the two lower clad

layers. In Fig 7 of this application, the two lower clad layers 10 (n-InP layer) are electrically connected via the bias layer 4 (n-InP layer). That is, the two lower clad layers and the bias layer are all made of the first conductivity type semiconductor.

On the other hand, in **Shimizu**, for example, in FIG.12B, the two clad layers 2A, 4B are electrically connected via the electrode 13A-2 made of Ti/Pt/Au. That is, in **Shimizu**, two clad layers 2A, 4B are connected via the electrode 13A-2. In **Shimizu**, layer 2A, layer 4B, and electrode 13A-2 do not each have the same conductivity type.

In **Shimizu**, cladding layer 2A and cladding layer 4B have different conductivity types. Cladding layer 2A has an n-type conductivity (Fig. 12B; Co. 7, lines 18-24), and cladding layer 4B has a p-type conductivity (Fig. 12B; col. 6, line 61-67). In view of the different conductivity types of layers 2A and 4B, it is clear that **Shimizu** does not teach that electrode 13A-2, layer 2A, and layer 4B all have the same conductivity type.

Contrary to the teachings of **Shimizu**, claim 1 of the present invention sets forth "a bias layer formed on a semiconductor substrate and made of a *first conductivity type* semiconductor; ... a first lower clad layer made of *the first conductivity type* semiconductor; ... and a second lower clad layer made of *the first conductivity type* semiconductor". Fig. 7 of the present

invention shows two lower clad layers 10 which each have an n-type conductivity.

In claim 1, both first and second phase modulation electrodes are maintained in the potential of a reverse-bias by applying a reverse-bias potential of direct current (DC) to the bias layer, thereby the push-pull drive is enabled.

However, in **Shimizu**, since characteristics of conductivity are different between the clad layers and the electrode connected to the two clad layers, both first and second phase modulation devices cannot be maintained in the potential of a reverse-bias.

Also, in claim 1, by applying DC bias current to the bias layer, and by connecting the upper clad layers of the first and second phase modulation electrodes to a high frequency electric power supply, the electric field of a reverse-sign can be applied to the first and second phase modulation electrodes. Accordingly, a push-pull drive, in which the first and second phase modulation electrodes, and the high frequency electric power supply are connected in series electrically, is enabled.

Skeie, **Tokano**, and **Nakabayashi** fail to remedy the above-described deficiencies of **Shimizu**.

Shimizu, Skeie, Tokano, and **Nakabayashi**, alone or in combination, fail to describe, teach, or suggest the following features of claim 1: "a bias layer formed on a semiconductor substrate and made of a *first conductivity type* semiconductor; ... a first lower clad layer made of *the first conductivity type* semiconductor; ... and a second lower clad layer made of *the first conductivity type* semiconductor" in combination with the other claimed features.

Furthermore, the combination of cited art fails to teach the "air-bridge" wiring set forth in claim 1.

Shimizu, Skeie, Tokano, and **Nakabayashi**, alone or in combination, fail to describe, teach, or suggest the following features of claim 1: "a first slot-line electrode formed on a side of the first optical waveguide and connected to the first phase modulation electrode via a first *air-bridge wiring*", in combination with the other claimed features.

Thus, Applicants respectfully submit that this rejection under 35 USC 103 should be withdrawn.

In view of the aforementioned amendments and accompanying remarks, claims are in condition for allowance, which action, at an early date, is requested.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosures: Replacement Sheets of Drawing (Fig. 7)
Petition for Extension of Time